

A NEW TRIGONALID WASP (HYMENOPTERA: TRIGONALIDAE) FROM EASTERN NORTH AMERICA

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Abstract.—*Orthogonalys bella*, n. sp., is described from Great Smoky Mountains National Park, Tennessee. It is the second species of *Orthogonalys* Schulz and the fifth species of Nearctic Trigonalidae. Characters separating it from *Orthogonalys pulchella* (Cresson) are given.

Key Words: hyperparasitoid, parasitoid, wasp, Trigonalidae

Inasmuch as a new trigonalid has not been discovered in the Nearctic for 108 years, one would assume that the fauna is completely known. Nothing is sure, however, and surprisingly a new species was discovered during the All Taxa Biodiversity Inventory (ATBI) investigations of Great Smoky Mountains National Park (GRSM). One specimen, belonging to the genus *Orthogonalys* Schulz as defined by Carmean and Kimsey (1998), is so unique that it cannot be confused with the only other North American species of the genus, *O. pulchella* (Cresson 1869). In thousands of Malaise trap samples from GRSM and elsewhere in eastern United States (e.g., Smith 1996), many thousands of *O. pulchella* have been captured, but no *Orthogonalys* so remarkably different as the species described here. Only a single specimen is known, but another may not be found in a lifetime, and we consider it significant to document its existence.

About 88 species in 16 genera of Trigonalidae are known worldwide (Carmean and Kimsey 1998). Four genera, each with one

species, occur in the Nearctic Region. Townes (1956) was the last to revise the Nearctic fauna, Carlson (1979) cataloged the family, and Smith (1996) gave a key and reviewed the eastern North American species. Carmean (1995) reviewed and gave keys to the genera of Costa Rica, and Carmean and Kimsey (1998) presented a comprehensive phylogeny and review of the world fauna. Most trigonalids are hyperparasitoids of endoparasitic Ichneumonoidea and Tachinidae or parasitoids of Vespidae larvae. Completion of their life cycle depends on a sequence of chance circumstances leaving one to wonder how they survive. In brief, numerous eggs are laid randomly on plant foliage; the eggs must be ingested by a phytophagous insect, usually a caterpillar, which is already parasitized; the eggs hatch in the gut and the larvae enter the body of the caterpillar to search for a parasitoid on which the trigonalid larva develops. There is no further development unless the caterpillar is parasitized by another parasitoid. In species that are parasitoids of Vespidae, a caterpillar in-

fectured by a trigonalid must be taken as prey back to the vespid nest where the vespid larva serves as the final host. Reviews of biology are given by Townes (1956), Carlson (1979), Weinstein and Austin (1991), Carmean (1991, 1995), Smith (1996) and Carmean and Kimsey (1998).

***Orthogonalys bella* Smith and Stocks,
new species**
(Figs. 1–5)

Female.—Length, 5.5 mm; forewing length, 4.8 mm. *Color*: Antenna with segments 1–6 reddish brown to orange, segments 7–9 white, with only extreme apex of 9 blackish, segments 10 to apex black. Head black, with spot at middle of inner orbit, spot on lower inner orbit, clypeus, and mouthparts dark orange; palpi more whitish; apices of teeth of mandible black. Mesosoma black, with tegula whitish. Legs orange with coxae black, trochanters more whitish, and extreme apex of hind femur black. Metasoma black, with about anterior half dark orange and apical half black. Wings hyaline; veins and stigma black.

Head: Antenna 24-segmented, length slightly less than $3\times$ head width. Eyes small, round; in lateral view, far from hind margin of head; in front view, far apart and slightly diverging below, with lower interocular distance $1.8\times$ eye height and upper interocular distance $1.3\times$ eye height. Clypeus $3\times$ broader than its medial length. Second tooth of left mandible much longer and broader than apical and third teeth (mandibles closed, symmetry not observed). Malar space long, nearly $0.5\times$ eye height. Distance between toruli about half distance between inner margin of eye and torulus. Genal carina distinct, broad, about equal to 0.7 diameter of an ocellus, ending at hypostomal carina. In dorsal view, head strongly narrowing behind eyes. Head uniformly shining, with small punctures separated by several puncture diameters, somewhat denser and closer together on frons, and very fine on malar area, with surface appearing dull. *Mesosoma*: Smooth, shining; pronotum

laterally with several straight carinae; mesepisternum with broad transverse sulcus with carinae, surface above sulcus shiny but roughened, below sulcus smooth, shining and sparsely punctate; mesonotum smooth, with scattered punctures, transverse sulcus anterior to scutellum with short carinae, scutellum low and evenly convex, without central groove, with scattered punctures; metanotum shining, with few punctures anteriorly; propodeum with areolate-rugose sculpturing, Propodeal foramen U-shaped. Forewing with submarginal cell 2 not petiolate. Posterior margin of hind coxa with sharp carina extending length of coxa, with dorsal part of carina sharply angulate; anterior margin of hind coxa with less developed carina; hind coxa rectangular in lateral view. Hind trochanter 3-segmented. Inner hind tibial spur shorter than apical width of hind tibia. Tarsal claws bifid, with both teeth subequal in length. *Metasoma*: Smooth and shining, with short fine carinae at extreme base of first segment. Sternal armature absent. Ovipositor sheath broad, with length subequal to its height.

Male.—Unknown.

Holotype.—Female, from Great Smoky Mountains National Park, Tennessee, labeled “TN: Sevier Co., GRSM, ATBI Plot Brushy Mountain, Malaise trap MT 14, 280000E, 3950599N, 3–18 June 2002, BMerritt, MT1420020618.” Provisionally deposited in the National Museum of Natural History, Smithsonian Institution, Washington, DC, pending mutual resolution and agreement with the National Park Service regarding specimen deposition.

Habitat.—Malaise trap #14 at Brushy Mountain (elevation 4,810' [1,466 m]) was located in a *Rhododendron* heath bald. The bald habitat is a *Kalmia latifolia* L.—*Rhododendron catawbiense* Michx.—(*Gaylussacia baccata* (Wangenh.) K. Koch., *Pieris floribunda* Benth. & Hook., *Vaccinium corymbosum* L.) [Ericaceae] shrubland alliance, as documented by NatureServe, a non-profit conservation organization work-



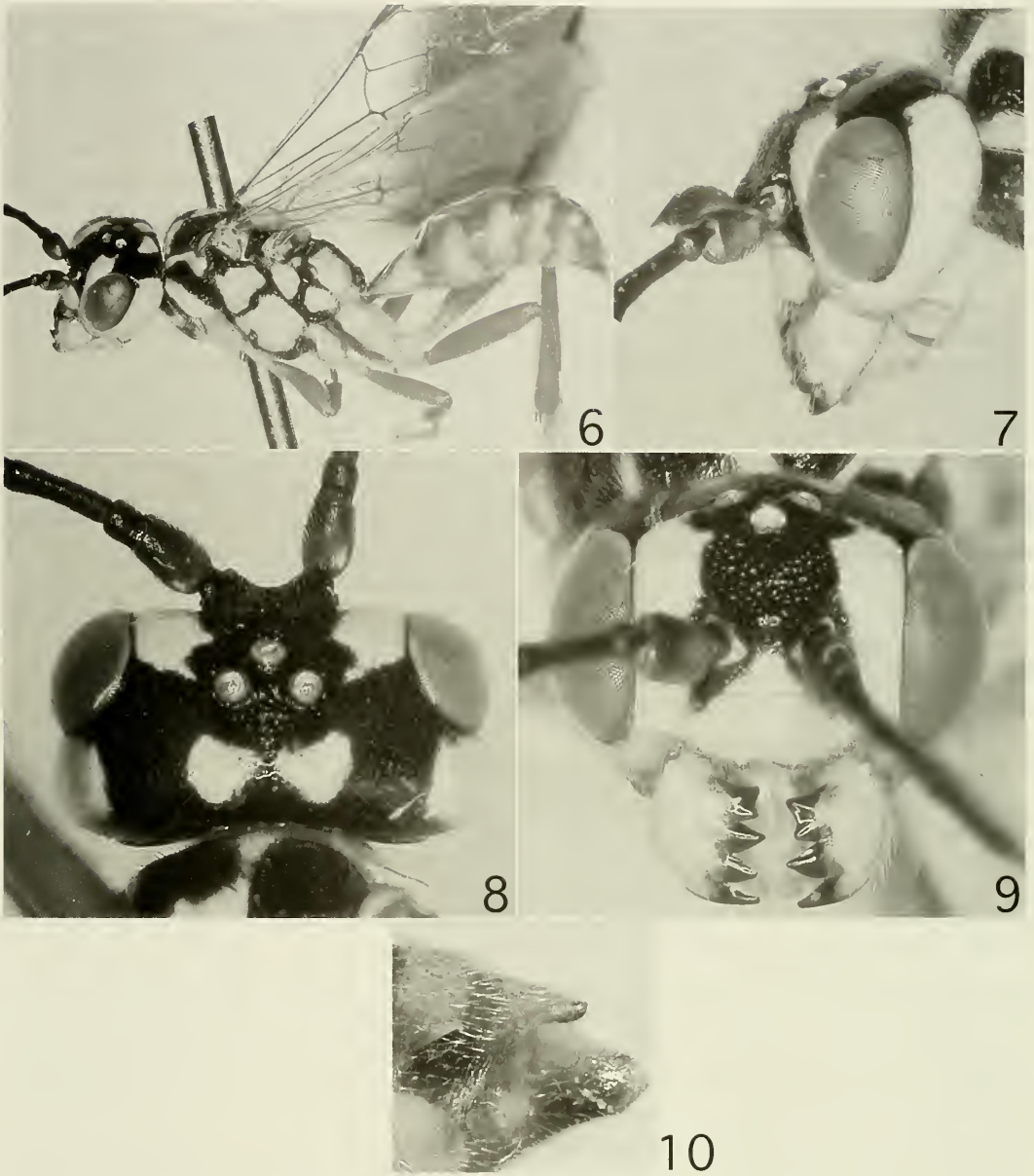
Figs. 1-5. *Orthogonalys bella*. 1, Lateral view. 2, Head, lateral view. 3, Head, dorsal view. 4, Head, front view. 5, Apex of abdomen and sheath, lateral view.

ing in partnership with GRSM to inventory plant communities.

Etymology.—The name reflects the authors' concept of the species—beautiful, from the Latin *bellus*.

Diagnosis and discussion.—*Orthogonalys pulchella*, the only other North American species of the genus, occurs from

southeastern Canada through eastern United States to Mexico. Comparison of *O. bella* with *O. pulchella* is shown in Figs. 1-10. Numerous characteristics separate the two species. *Orthogonalys pulchella* is much more richly marked with yellow and orange; the antennal length is more than 3× the head width; antennal segments 9-13



Figs. 6–10. *Orthogonalys pulchella*. 6, Lateral view. 7, Head, lateral view. 8, Head, dorsal view. 9, Head, front view. 10, Apex of abdomen and sheath, lateral view.

and sometimes 14 are white; the genal carina is narrower, less than half the diameter of an ocellus; the eyes are larger, more oval, closer together in front view, and closer to the hind margin of the head in lateral view; in front view, the inner margin of the eyes are subparallel, not diverging below; the

apical three teeth of the left mandible are subequal in size; the clypeus is about $2\times$ broader than its medial length; the malar space is shorter, about $0.2\times$ the eye height; in dorsal view the head is straighter behind the eyes and is more rectangularly shaped; the mesoscutellum has a shallow, longitu-

dinal groove; there is no sharp carina on the posterior margin of the hind coxa and the hind coxa is elongate oval in lateral view; the inner apical tibial spur is longer than the apical width of the hind tibia; the tarsal claws are bifid, with the inner tooth longer and broader than outer tooth; and the sheath is narrower, nearly twice as long as broad.

Carmean and Kimsey (1998) listed 11 world species of *Orthogonalys*, one from North America, one from South America, three from Japan, three from southeastern Asia, and three from Africa. The only South American species, *O. boliviana* Schulz 1905 is almost indistinguishable from *O. pulchella*. The overall black coloration resembles some of the Asian species, which are mostly black, with few white or brown markings as opposed to the rich white and orange markings of species from the rest of the world (Carmean and Kimsey 1998). *Orthogonalys bella* does not key to any of the Japanese species treated by Tsuneki (1991). It is closest to *O. fukuensis* Tsuneki 1991, but in *O. fukuensis* only the first two metasomal tergites are broadly brownish white and the thorax has no yellow or brown marks. Additionally, based on examination of *O. hagogomensis* Teranishi 1929 and based on Tsuneki (1991), the Japanese species have less developed carinae on the hind coxae, the second tooth of the left mandible is the same size as the first and third teeth, the malar space is narrow (as in *O. pulchella*), and the tarsal claws have a large inner tooth. *Orthogonalys bella*, mostly characterized by its predominantly black color, does not agree with descriptions of the other species listed by Carmean and Kimsey (1998).

The possible resemblance of *O. bella* to eastern Asian species rather than the North America species may be another example of biogeographical similarities between eastern United States and eastern Asia, though color is not a good indication of relationships. There are undoubtedly many examples, but it is reminiscent of a sawfly, *Strongylogaster lata* Smith and Naito 1995

(Tenthredinidae), which is known from only a few specimens from the mid-Atlantic states. *Strongylogaster lata*, only discovered after 100 or more years of collecting in such a well-collected area, belongs to a group of species known only from eastern Asia and is very unlike the other North American species of the genus (Smith and Naito 1995).

Besides the two species of *Orthogonalys*, the only other trigonalid collected in GRSM is *Taeniogonalys gundlachi* (Cresson 1865), which occurs from eastern United States to Costa Rica. *Lycogaster pullata* Schuckard 1841, another eastern North American species, probably occurs there, but they are seldom collected in Malaise traps (Smith 1996). No other trigonalids were collected in the traps at Brushy Mountain during the inventory of 2001 and 2002.

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